City of Denver Transforms Traffic Control Network Operations

Project Overview

Traffic control systems have a lot at stake, promoting the orderly movement of vehicular and pedestrian traffic to not only encourage the steady flow of activity—but to preserve public safety. Traffic lights, cameras, sensors and other connections have become an integral part of society. Despite the public's reliance on the organizational structure and uptime of roadway signals, many are unaware of the resources necessary to effectively manage these systems.

For any traffic control network (TCN), signal management consists of many moving parts. Aside from maintaining outages, teams are tasked with geographic configuration, proportioning population to the number of signals, congestion mitigation, signal timing and more.

The increasing number of high-throughput devices, such as cameras, have only made this more complex. While traffic divisions rely on the active prioritization and collection of information to expedite critical data transfer, higher bandwidth requirements have created issues for legacy systems. As one of the transportation industry's most visible services, officials must prioritize traffic engineering and operations.

Sitting among the top 20 most populated cities in the United States, this has been no small feat for the City and County of Denver, which began its journey to modernization after its primary devices were discontinued by its long-standing vendor. Denver's network had already experienced dozens of failures with its existing technology, and with its main technician retiring, they had to act fast. City planners reasonably began to worry there was only a matter of time before bottlenecks and outages—or worst-case scenario, a complete crash of the system— would cause detrimental effects.

As Denver continued to experience rapid population growth, its TCN currently consisting of more than 6,000 devices, legacy systems wouldn't cut it. Continued network expansion was inevitable for this large-scale project. Its massive size and complexities required a highly configurable, reliable and comprehensible solution that could grow along with its network.

Increasing gridlock challenges were reduced through large-scale operating system upgrades, in partnership with Hirschmann, a Belden brand.

To address its population and infrastructure growth, the City and County of Denver—Colorado's largest municipality—underwent an upgrade to its traffic control network. Despite the size and operational complexities of the Denver area, city officials can now confidently manage its current and future traffic control needs with reliable, high-performing next-generation technology.

**Be certain.
Belden.**

Project Needs and Challenges

City engineers sought a solution that could expand enough to meet the needs of Denver's quickly—and constantly—changing infrastructure. Reliability, ease of use and defensibility were primary considerations during vendor selection, but also top-of-mind for Denver engineers was timelessness.

For this transformation, a future-proof infrastructure meant:

- Attention to design: There was little need for redundancy capabilities and segmentation of Denver's old layout, meaning they needed to redesign their network from the ground up, restructuring based on the City and County's rapidly evolving IoT device installations.

- Configuration with legacy devices for minimal downtime: To ensure continuity and avoid a major malfunction of its traffic network, the City needed next-generation technology that would comply to the load and security specifications required in today's increasingly connected IoT traffic devices, without disrupting functions directing current traffic operations.

- Higher bandwidth and scalability: Denver's previous iterations were extremely limited in terms of performance. And lagging, or prolonged delays, are not feasible for traffic signal operations. The system required higher throughput with the opportunity to expand the network without another device replacement.

- User-friendly maintenance: Traffic operations are mission-critical to any city and downtime must be resolved as quickly as possible. Systems that were too complicated to configure were not practical in this environment. Knowledge of network design and maintenance needed to exist outside of those involved with maintenance and upkeep.

"From CV technology to UPS systems, the current traffic operations field equipment is increasingly reliant on IP networked devices. So, we needed a field hardened, reliable, high bandwidth network switch that could meet our rapidly changing transportation systems equipment. Our decision to go with Belden has allowed us to have the proper edge deployed equipment in place, so we can continue to modernize our transportation system safely and effectively." Said Michael Finochio, engineering manager for the City and County of Denver

The Belden Solution – A Phased Approach

As part of the planning process, officials and Belden engineers worked together in the field to identify issues that would likely become problematic down the road and mapped out a customized plan.

A network as large and complex as Denver's city-wide traffic system physically could not be converted to a new platform in a single instance. This large-scale conversion continues to be conducted in stages to ensure performance and uptime, while building safeguards and redundancies on the backend.

Phase One: The Test Drive

To meet the City and County's performance and uptime requirements, as well as provide the evidence the team needed to continue modernization, a combination of existing and Hirschmann devices were suggested for the first phase of the migration.

In 2013, Belden field application engineers joined City and County engineers out in the field for testing, making sure the suggested plans and recommendations were ideally suited for the network's environment. Approximately 20 MACH1040 switches were installed to match the redundancy requirements of Denver's TCN and the migration project was in full swing.

Phase Two: Getting the Green Light

The second phase centered on the annual replacement of legacy equipment with Hirschmann devices. These gradual upgrades involve the migration from switches with underperforming redundancy capabilities, to the faster, more dependable performance of Hirschmann's switches.

Although Belden's engineers are not always actively on-site to address network gaps as they arise, the graphical interface of the Industrial HiVision management software and seamless configuration capabilities has enabled Denver's technicians to complete tasks that once seemed impossible.

Phase Three: No More Roadblocks

Considering the constant replacement of lights and installation of other devices to improve Denver's TCN, it's no surprise the project is still underway. Complemented by the dedicated, day-to-day technical and design support of Belden's engineers and the graphical features of Industrial HiVision, a slow—but steady—transformation has allowed Denver to maintain system integrity without compromising comprehensibility.
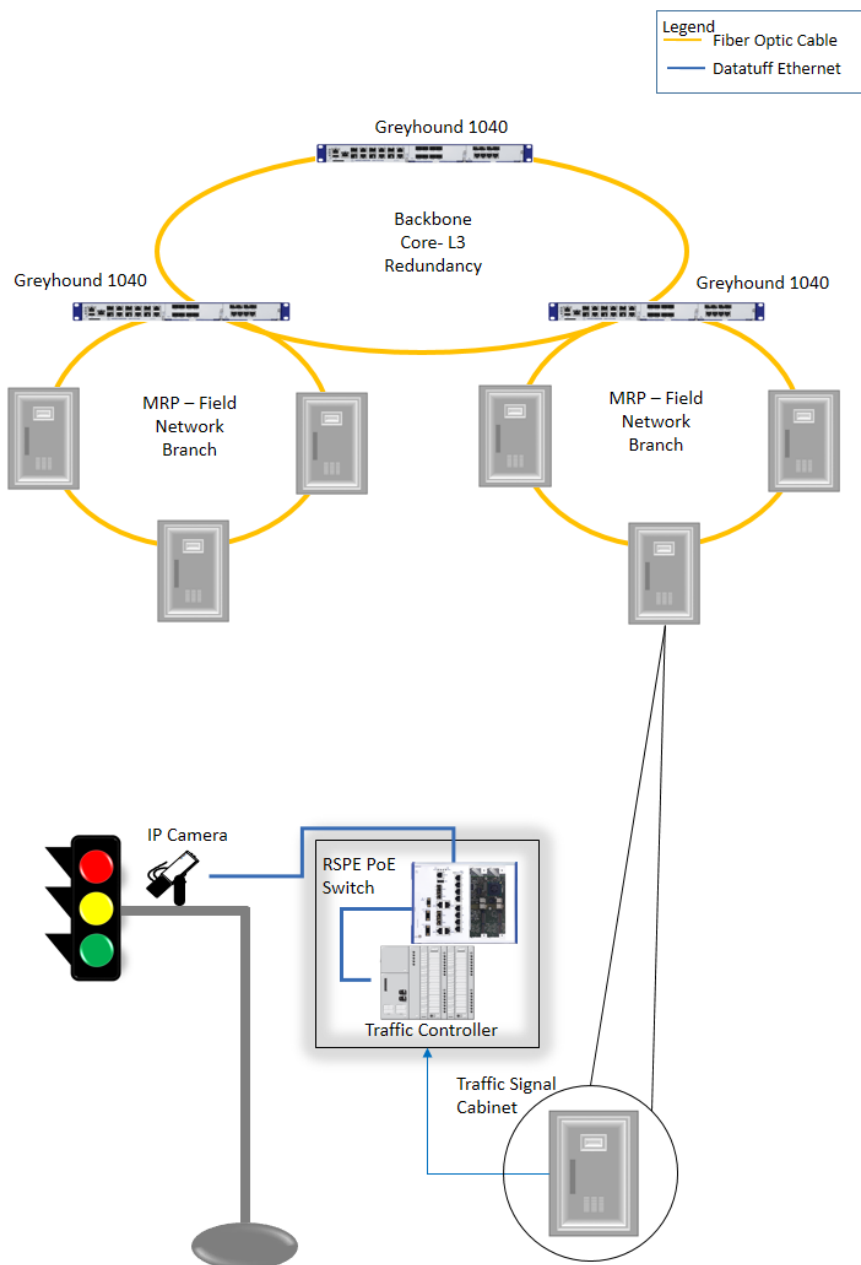
"The demands presented by the City and County of Denver were unique in that there were multiple layers of complexity that needed to be accounted for. This was truly a case of a zero-fail standard. When working with government agencies the importance of not only designing a network that operates as intended, but is also highly secure, cannot be overstated. The City and County of Denver was a great partner and together, we built a traffic control network that can serve as a model for municipalities all over the world." Scott Kornblue, field application engineer at Belden

Engineering Explained: Why Redundancy Matters

At the heart of the Belden network solution is a core redundant ring topology, which facilitates multiple subrings that provide redundant network connectivity and robustness to Denver's TCN.

By using this technology, as opposed to integrating other redundancy techniques, Belden significantly increased the availability and resiliency of the network—providing multiple paths for communication. Apart from the industrial-grade equipment recommended, Belden has the advantage of a fault-tolerant network that can handle multiple consecutive failures happening in a very short period.

The design integrated robustness and contingencies that allow the TCN to operate transparently, regardless of the disruptions that arise—whether it be a network failure, disconnection of copper or fiber cables, or another unexpected circumstance. Essentially, the industrial ring topology makes transition more seamless and comprehensive for engineers with little or no experience in design or upkeep.

Legend
Fiber Optic Cable
Datatuff Ethernet

Greyhound 1040

Backbone Core- L3 Redundancy

Greyhound 1040

Greyhound 1040

MRP – Field Network Branch

MRP – Field Network Branch

IP Camera

RSPE PoE Switch

Traffic Controller

Traffic Signal Cabinet

Why Belden?

The ability to offer a robust, easy-to-use solution that could both meet the needs of today and scale to meet the challenges of tomorrow solidified Denver's decision to partner with Belden in modernizing its TCN infrastructure. The increasing benefits of the migration, however, are not solely reliant on the consultancy and conversion of Denver's devices to Hirschmann switches.

Thanks to the success Denver has found in the industrial hardware, the City has also turned to Belden's Tripwire and Tofino brands to enhance the visual capabilities of its Industrial HiVision software. The highly configurable offerings were introduced to Denver to help them achieve a holistic view and better management of its massive network. Together, Belden's solutions will provide virtually foolproof detection of behavioral anomalies, as well as maximize efficiency at every point of the network.
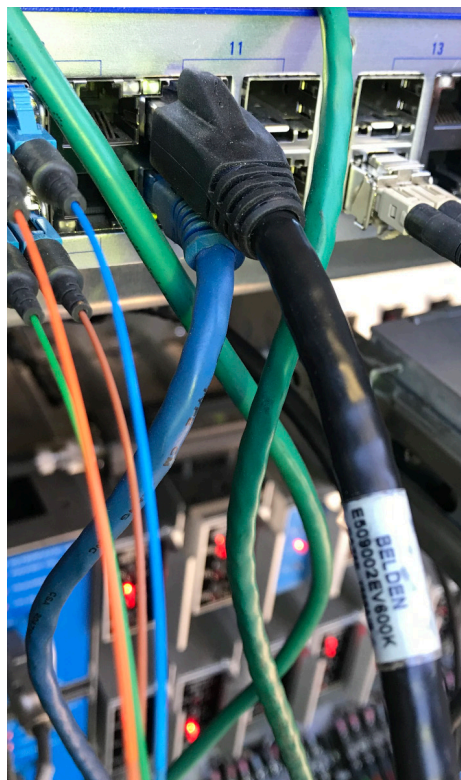
Product Details

The City and County of Denver used the following Hirschmann products to transform its TCN operations:

RSPE Switches

Designed for networks that require 100% availability for data communications, the compact and extremely robust RSPE switches comprise a basic device with eight twisted pair ports and four combination ports that support Fast Ethernet or Gigabit Ethernet. The device can be extended to provide up to 28 ports by adding two media modules.

- Future-proof network design and best-possible investment protection
- Maximum productivity for machines and systems
- All-around protection against network attacks and operating errors

MACH1040 Full Gigabit Ethernet Switches

Designed specifically for use in the power industry, they can be connected to form sub-networks, which in turn can be linked up to each other.

- Designed for harsh environments with a fanless cooling system, high vibration resistance and an operating temperature range of -40˚C to +70˚C
- Comprehensive management and redundancy methods for configuration and diagnostics
- Features a redundant power supply system and fast functionality with non-blocking architecture

Industrial HiVision Network Management Software

Industrial HiVision safely and automatically identifies network devices and helps you configure and monitor them. The result is all-around network protection and high-performance network management, all while making engineering teams more efficient.

- Features a highly graphical user interface for instant vision of key performance indicators
- Enables timely remediation through expedited faults detection to improve uptime and security
- Syncs to all network infrastructure using MultiConfig—allowing easy identification, mapping and configuration across the network in real time

About Belden

Belden Inc., a global leader in high quality, end-to-end signal transmission solutions, delivers a comprehensive product portfolio designed to meet the mission-critical network infrastructure needs of industrial, enterprise and broadcast markets. With innovative solutions targeted at reliable and secure transmission of rapidly growing amounts of data, audio and video needed for today's applications, Belden is at the center of the global transformation to a connected world. Founded in 1902, the company is headquartered in St. Louis, USA, and has manufacturing capabilities in North and South America, Europe and Asia.

Be certain.
Belden.